DEPARTMENT OF CONSUMER AND INDUSTRY SERVICES

DIRECTOR=S OFFICE

OCCUPATIONAL HEALTH STANDARDS

Filed with the Secretary of State on January 1, 1975

This rule takes effect 15 days after filing with the Secretary of State

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PART 529. WELDING, CUTTING AND BRAZING

Rule 3240 Welding, cutting and brazing.

(1) Definitions: As used in this subsection.

(a) "Welder" and "welding operator" mean any operator of electric or gas welding and cutting equipment. [1910.251(a)]

(b) "Approved" means listed or approved by a nationally recognized testing laboratory, such as Factory Mutual Engineering Corporation or Underwriters' Laboratories, Inc. [1910.251(b)]

(c) All other welding terms are used in accordance with American Welding Society - Terms and Definitions - A3.0-1969. [1910.251(c)]

(2) Operation and maintenance of arc welding and cutting equipment. Workmen assigned to operate or maintain arc welding equipment shall be acquainted with the requirements of subsections (4) and (5) of this rule; if doing gas-shielded arc welding*, also Recommended Safe Practices for Gas-Shielded Arc Welding, A6.1-1966, American Welding Society. [1910.252(b)(4)(i)]

(3) Installation and operation of flash welding equipment.

(a) Ventilation and flash guard. Flash welding machines shall be equipped with a hood to control flying flash. In cases of high production, where materials may contain a film of oil and where toxic elements and metal fumes are given off, ventilation shall be provided in accordance with subsection (5) of this rule. [1910.252(c)(4)(i)]

(b) Safety requirements for flash welding machines are in the Occupational Safety Standards for General Industry.

(4) Protection of personnel.

(a) Working in confined spaces. See Rule 3303(2).

(b) Safety requirements for work in confined spaces appear in the Occupational Safety Standards for General Industry.

(5) Health protection and ventilation.

(a) General.

(i) Contamination. The requirements in this subsection have been established on the basis of the following three factors in arc and gas welding which govern the amount of contamination to which welders may be exposed: [1910.252(f)(1)(i)]

(A) Dimensions of space in which welding is to be done (with special regard to height of ceiling). [1910.252(f)(1)(i)(a)]

(B) Number of welders. [1910.252(f)(1)(i)(b)]

(C) Possible evolution of hazardous fumes, gases, or dust according to the metals involved. [1910.252(f)(1)(i)(c)]

(ii) Ventilation. It is recognized that in individual instances other factors may be involved in which case ventilation or respiratory protective devices should be provided as needed to meet the equivalent requirements of this rule. Such factors would include: [1910.252(f)(1)(ii)]

(A) Atmospheric conditions. [1910.252(f)(1)(ii)(a)]

(B) Heat generated. [1910.252(f)(1)(ii)(b)]

(C) Presence of volatile solvents. [1910.252(f)(1)(ii)(c)]

(iii) Screens. When welding must be performed in a space entirely screened on all sides, the screens shall be so arranged that no serious restriction of ventilation exists. It is desirable to have the screens so mounted that they are about 2 feet above the floor unless the work is performed at so low a level that the screen must be extended nearer to the floor to protect nearby workers from the glare of welding. [1910.252(f)(1)(iii)]

(iv) Maximum allowable concentration. Local exhaust or general ventilating systems shall be provided and arranged to keep the amount of toxic fumes, gases, or dusts below the maximum allowable concentration as specified in Chapter II of these rules. [1910.252(f)(1)(iv)]

(v) Precautionary labels. A number of potentially hazardous materials are employed in fluxes, coatings, coverings, and filler metals used in welding and cutting or are released to the atmosphere during welding and cutting. These include, but are not limited to, the materials itemized in paragraphs (f) through (m) of this subsection. The suppliers of welding materials shall determine the hazard, if any, associated with the use of their materials in welding, cutting, etc. [1910.252(f)(1)(v)]

(A) All filler metals and fusible granular materials shall carry the following notice, as a minimum, on tags, boxes, or other containers:

CAUTION

Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. Use adequate ventilation. See ANSI Z49.1-1967 Safety in Welding and Cutting published by the American Welding Society. [1910.252(f)(1)(v)(a)]

(B) Brazing (welding) filler metals containing cadmium in significant amounts shall carry the following notice on tags, boxes, or other containers:

WARNING
CONTAINS CADMIUM--POISONOUS FUMES MAY BE FORMED ON HEATING

Do not breathe fumes. Use only with adequate ventilation such as fume collectors, exhaust ventilators, or air-supplied respirators. See ANSI Z49.1-1967.

If chest pain, cough, or fever develops after use, call physician immediately.

Keep children away when using.
[1919.252(f)(1)(v)(b)]

(C) Brazing and gas welding fluxes containing fluorine compounds shall have a cautionary wording to indicate that they contain fluorine compounds. One such cautionary wording recommended by the American Welding Society for brazing and gas welding fluxes reads as follows:

CAUTION
CONTAINS FLUORIDES

This flux when heated gives off fumes that may irritate eyes, noise and throat.

1. Avoid fumes--use only in well-ventilated spaces.
2. Avoid contact of flux with eyes or skin.
3. Do not take internally.

[1910.252(f)(1)(v)(c)]

(b) Ventilation for general welding and cutting.

(i) General. Mechanical ventilation shall be provided when welding or cutting is done on metals not covered in paragraphs (f) through (m) of this subsection. (For specific materials, see the ventilation requirements of paragraphs (f) through (m) of this subsection.)

(A) In a space of less than 10,000 cubic feet per welder. [1910.252(f)(2)(i)(a)]

(B) In a room having a ceiling height of less than 16 feet. [1910.252(f)(2)(i)(b)]

(C) In confined spaces or where the welding space contains partitions, balconies, or other structural barriers to the extent that they significantly obstruct cross ventilation. [1910.252(f)(2)(i)(c)]

(ii) Minimum rate. Such ventilation shall be at the minimum rate of 2,000 cubic feet per minute per welder, except where local exhaust hoods and booths as per paragraph (c) of this subsection, or air-line respirators approved by the U.S. Bureau of Mines for such purposes are provided. Natural ventilation is considered sufficient for welding or cutting operations where the restrictions in subdivision (i) of this paragraph are not present. [1910.252(f)(2)(ii)]

(c) Local exhaust hoods and booths. Mechanical local exhaust ventilation may be by means of either of the following: [1910.252(f)(3)]

(i) Hoods. Freely movable hoods intended to be placed by the welder as near as practicable to the work being welded and provided with a rate of airflow sufficient to maintain a velocity in the direction of the hood of 100 linear feet per minute in the zone of welding when the hood is at its most remote distance from the point of welding. The rates of ventilation required to accomplish this control velocity using a 3-inch wide flanged suction opening are shown in the following table:

Welding zone (inches from arc or torch)	Minimum airflow[1] (cubic feet/minute)	Duct diameter (inches [2])
4 to 6	150	3
6 to 8	275	3 1/2
8 to 10	425	4 1/2
10 to 12	600	5 1/2

[1]When brazing with cadmium-bearing materials or when cutting on such materials, increased rates of ventilation may be required.

[2]Nearest half-inch duct diameter based on 4,000 feet per minute velocity in pipe. [1910.252(f)(3)(i)]

(ii) Fixed enclosure. A fixed enclosure with a top and not less than two sides which surround the welding or cutting operations and with a rate of airflow sufficient to maintain a velocity away from the welder of not less than 100 linear fee per minute. [1910.252(f)(3)(ii)]

(d) Ventilation in confined spaces. See Rule 3303(2).

(e) Reserved.

(f) Fluorine compounds.

(i) General. In confined spaces, welding or cutting involving fluxes, coverings, or other materials which contain fluorine compounds shall be done in accordance with Rule

3303(2). A fluorine compound is one that contains fluorine as an element in chemical combination, not as a free gas. [1910.252(f)(5)(i)]

(ii) Maximum allowable concentration. The need for local exhaust ventilation or air-line respirators for welding or cutting in other than confined spaces will depend upon the individual circumstances. However, experience has shown such protection to be desirable for fixed-location production welding and for all production welding on stainless steels. Where air samples taken at the welding location indicate that fluorides liberated are below the maximum allowable concentration, such protection is not necessary. [1910.252(f)(5)(ii)]

(g) Zinc.

(i) Confined spaces. In confined spaces, welding or cutting involving zinc-bearing base or filler metals or metals coated with zinc-bearing materials shall be done in accordance with Rule 3303(2). [1910.252(f)(6)(i)]

(ii) Indoors. Indoors, welding or cutting involving zinc-bearing base or filler metals coated with zinc-bearing materials shall be done in accordance with paragraph (c) of this subsection. [1910.252(f)(6)(ii)]

(h) Lead

(i) Confined spaces. In confined spaces, welding involving lead-base metals (erroneously called lead-burning) shall be done in accordance with Rule 3303(2). [1910.252(f)(7)(i)]

(ii) Indoors. Indoors, welding involving lead-base metals shall be done in accordance with paragraph (c) of this subsection. [1910.252(f)(7)(ii)]

(iii) Local ventilation. In confined spaces or indoors, welding or cutting involving metals containing lead, other than as an impurity, or involving metals coated with lead-bearing materials, including paint shall be done using local exhaust ventilation or air-line respirators. Outdoors such operations shall be done using respiratory protective equipment approved by the U.S. Bureau of Mines for such purposes. In all cases, workers in the immediate vicinity of the cutting operation shall be protected as necessary by local exhaust ventilation or air-line respirators. [1910.252(f)(7)(iii)]

(i) Beryllium. Welding or cutting indoors, outdoors, or in confined spaces involving beryllium-containing base or filler metals shall be done using local exhaust ventilation and air-line respirators unless atmospheric tests under the most adverse conditions have established that the workers' exposure is within the acceptable concentrations defined by Chapter II. In all cases, workers in the immediate vicinity of the welding or cutting operations shall be protected as necessary by local exhaust ventilation or air-line respirators. [1910.252(f)(8)]

(j) Cadmium.

(i) General. Welding or cutting indoors or in confined spaces involving cadmium-bearing or cadmium-coated base metals shall be done using local exhaust ventilation or air-line respirators unless atmospheric tests under the most adverse conditions have established that the workers' exposure is within the acceptable concentrations defined by Chapter II. Outdoors such operations shall be done using respiratory protective equipment such as fume respirators approved by the U.S. Bureau of Mines for such purposes. [1910.252(f)(9)(i)]

(ii) Confined space. Welding (brazing) involving cadmium-bearing filler metals shall be done using ventilation as prescribed in Rule 3303(2) if the work is to be done in a confined space. [1910.252(f)(9)(ii)]

(k) Mercury. Welding or cutting indoors or in a confined space involving metals coated with mercury-bearing materials including paint, shall be done using local exhaust ventilation or air-line respirators unless atmospheric tests under the most adverse conditions have established that the workers' exposure is within the acceptable concentrations defined by Chapter II. Outdoors such operations shall be done using respiratory protective equipment approved by the U.S. Bureau of Mines for such purposes. [1910.252(f)(10)]

(l) Cleaning compounds.

(i) Manufacturer's instructions. In the use of cleaning materials, because of their possible toxicity or flammability, appropriate precautions such as manufacturer's instructions shall be followed. [1910.252(f)(11)(i).

(ii) Degreasing. Degreasing or other cleaning operations involving chlorinated hydrocarbons shall be so located that no vapors from these operations will reach or be drawn into the atmosphere surrounding any welding operation. In addition, trichloroethylene and perchloroethylene should be kept out of atmospheres penetrated by the ultraviolet radiation of gas-shielded welding operations. [1910.252(f)(11)(ii)]

(m) Cutting of stainless steels. Oxygen cutting, using either a chemical flux or iron powder or gas-shielded arc cutting of stainless steel, shall be done using mechanical ventilation adequate to remove the fumes generated. [1910.252(f)(12)]

(n) First-aid equipment. First-aid equipment shall be available at all times. On every shift of welding operations there should be present employees trained to render first aid. All injuries shall be reported as soon as possible for medical attention. First aid shall be rendered until medical attention can be provided. [1910.252(f)(13)]

(6) Industrial applications.

(a) Transmission pipeline.

(i) General. The requirements of subsections (2), (3), and (5) of this rule shall be observed. The applicable Occupational Safety Standards for General Industry shall also be observed. [1910.252(g)(1)(i)]

(ii) Field shop operations. Where field shop operations are involved for fabrication of fittings, river crossing, road crossings, and pump compressor stations, the requirements of subsections (2), (4), and (5) of this rule shall be observed. The applicable Occupational Safety Standards for General Industry shall also be observed. [1910.252(g)(1)(ii)]

(iii) X-ray inspection. See Rule 2410(18)(a).

(b) Mechanical piping systems.

(i) General. The requirements of subsections (2), (4) and (5) of this subsection shall be observed. The applicable Occupational Safety Standards for General Industry shall also be observed. [1910.252(g)(2)(i)]

(ii) X-ray inspection. See Rule 2410(18)(b).